REC'D 15 DEC 2004
WIPO PCT

IB/2004/052795

PA 1251697

THE UNITED STATES OF AMERICA

TO ALL TO WHOM THESE PRESENTS SHALL COME:

UNITED STATES DEPARTMENT OF COMMERCE

United States Patent and Trademark Office

November 26, 2004

THIS IS TO CERTIFY THAT ANNEXED HERETO IS A TRUE COPY FROM THE RECORDS OF THE UNITED STATES PATENT AND TRADEMARK OFFICE OF THOSE PAPERS OF THE BELOW IDENTIFIED PATENT APPLICATION THAT MET THE REQUIREMENTS TO BE GRANTED A FILING DATE UNDER 35 USC 111.

APPLICATION NUMBER: *60/530,159*
FILING DATE: *December 17, 2003*

PRIORITY DOCUMENT
SUBMITTED OR TRANSMITTED IN COMPLIANCE WITH RULE 17.1(a) OR (b)

By Authority of the
COMMISSIONER OF PATENTS AND TRADEMARKS

L. Edelen

L. EDELEN
Certifying Officer

15992 U.S.PTO
121703

Please type a plus sign (+) inside this box → +

PTO/SB/16 (02-01)
Approved for use through 10/31/2002. OMB 0651-0032
Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PROVISIONAL APPLICATION FOR PATENT COVER SHEET

This is a request f r filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53 (c).

Express Mail Label No. EV 312 068 670 US   Date of Dep sit: 17 December 2003

INVENTOR(S)

Given Name (first and middle [if any])	Family Name or Surname	Residence (City and either State or Foreign Country)
Murray	Gillies	Eindhoven, The Netherlands
Mark T.	Johnson	Eindhoven, The Netherlands

17510 U.S. PTO 60/530150
121703

☐ *Additional inventors are being named on the _____ separately numbered sheets attached hereto*

TITLE OF THE INVENTION (280 characters max)

EMBEDDED LOCATION CODES FOR E-BRUSH POSITION DETERMINATION

CORRESPONDENCE ADDRESS

Direct all correspondence to:

☒ Customer Number 24737 → *24737*

OR *Type Customer Number here*

☒ Firm *or* Individual Name	PHILIPS ELECTRONICS NORTH AMERICA CORPORATION
Address	345 SCARBOROUGH ROAD
Address	P. O. Box 3001
City	BRIARCLIFF MANOR · State: NY · ZIP: 10510
Country	USA · Telephone: (914) 333-0222 · Fax: (914) 332-0615

ENCLOSED APPLICATION PARTS (*check all that apply*)

☒ Specification *Number of Pages* 10   ☐ CD(s), Number

☒ Drawing(s) *Number of Sheets* 6   ☐ Other (specify)

☐ Application Data Sheet. See 37 CFR 1.76

METHOD OF PAYMENT OF FILING FEES FOR THIS PROVISIONAL APPLICATION FOR PATENT (*check one*)

☐ Applicant claims small entity status. See 37 CFR 1.27.

☐ A check or money order is enclosed to cover the filing fees

FILING FEE AMOUNT ($)

☒ The Commissioner is hereby authorized to charge filing fees or credit any overpayment to Deposit Account Number: 14-1270   160.00

☐ Payment by credit card. Form PTO-2038 is attached.

The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.

☒ No.

☐ Yes, the name of the U.S. Government agency and the Government contract number are: _____.

Respectfully submitted,
SIGNATURE Frank Keegan   Date 12/17/2003

REGISTRATION NO.: 50,145
(*if appropriate*)

TYPED or PRINTED NAME FRANK KEEGAN   Docket Number: US030474

TELEPHONE (914) 333-9669

USE ONLY FOR FILING A PROVISIONAL APPLICATION FOR PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of	Atty. Docket
MURRAY GILLIES, ET.AL.	US030474
Serial No.	Group Art Unit
Filed: CONCURRENTLY	Ex.

Title: EMBEDDED LOCATION CODES FOR E-BRUSH POSITION DETERMINATION

Honorable Commissioner of Patents and Trademarks
Alexandria, VA 22313-1450

AUTHORIZATION PURSUANT TO 37 CFR §1.136(a)(3)
AND TO CHARGE DEPOSIT ACCOUNT

Sir:

The Commissioner is hereby requested and authorized to treat any concurrent or future reply in this application requiring a petition for extension of time for its timely submission, as incorporating a petition for extension of time for the appropriate length of time.

Please charge any additional fees which may now or in the future be required in this application, including extension of time fees, but excluding the issue fee unless explicitly requested to do so, and credit any overpayment, to Deposit Account No. 14-1270.

Respectfully submitted,

By Frank Keegan 12/4/03

Frank Keegan, Reg. 50,145
Attorney
(914) 333-9669

S:\ke\US030474-AUTH.DOC

EMBEDDED LOCATION CODES FOR E-BRUSH POSITION DETERMINATION

The present invention generally relates to electrophoretic displays. The present invention specifically relates to location codes for writing an image onto an electrophoretic display.

Electronic ink or E-ink as known in the art can be formed from capsules that contain black negatively charged particles and white positively charged particles. In an electrophoretic display, the capsules are typically disposed between a pair of electrodes whereby an application of a voltage of a particular polarity can switch the system between black and white. Some known electrophoretic displays are optically addressable via an incorporation of a photoconductor layer between the electrodes. Upon illumination from a scanning laser beam, the photoconductor becomes a conductor and the E-ink can be locally switched between black and white. The combination of E-ink and photoconductor is known in the art as E-paint, and a hand held device known as an E-brush houses the illumination source.

In order to achieve a desired image in the E-ink, it is imperative that an E-brush has the capability of accurately determining its position relative to the E-ink. The present invention advances the art by providing an electronic ink stack employing a front electrode, a back electrode, an organic photoconductor layer, an electronic ink layer, and one or more location codes. The electronic ink layer is disposed between the front electrode and the back electrode. When employed, the photoconductor is also disposed between the front electrode and the back electrode. The location code(s) are embedded within the front electrode, the back electrode, and/or the photoconductor layer (if employed).

The foregoing forms as well as other forms, features and advantages of the present invention will become further apparent from the following detailed description of the presently preferred embodiments, read in conjunction with the accompanying drawings. The detailed description and drawings are merely illustrative of the present invention rather than limiting, the scope of the present invention being defined by the appended claims and equivalents thereof.

FIG. 1 illustrates one embodiment of an electronic paint system in accordance with the present invention;

FIG. 2 illustrates an exploded view of a first embodiment of an E-ink stack in accordance with the present invention;

FIG. 3 illustrates a side view of the E-ink stack illustrated in FIG. 2;

FIG. 4 illustrates an exploded view of a first embodiment of an E-ink stack in accordance with the present invention;

FIG. 5 illustrates a side view of the E-ink stack illustrated in FIG. 4;

FIG. 6 illustrates an exploded view of a first embodiment of an E-ink stack in accordance with the present invention;

FIG. 7 illustrates a side view of the E-ink stack illustrated in FIG. 6;

FIG. 8 illustrates a flow chart representative of a method of providing various images in the E-ink stacks illustrated in FIGS. 2-7;

FIG. 9 illustrates an exemplary graphical representation of one embodiment in accordance of the present invention of a voltage amplitude modulation addressing scheme for revealing the location codes; and

FIG. 10 illustrates an exemplary graphical representation of one embodiment in accordance of the present invention of a voltage slope modulation addressing scheme for revealing the location codes.

An electronic paint system 20 as illustrated in FIG. 1 employs a conventional monitor 30, a conventional computer 40, a conventional electronic brush 50, and a conventional controller 60 as will be appreciated by those having ordinary skill in the art. Electronic paint system 20 further employs a new and unique electronic ink stack 70 having embedded location codes exemplarily represented by the dashed circles shown in FIG. 1. The embedded location codes enable a user of system 20 to accurately produce an E-ink image on electronic ink stack 70 as will be further explained in connection with a subsequent description of FIG. 8 herein.

Each embodiment of electronic ink stack 70 in accordance with the present invention employs a front electrode, a back electrode and an electronic ink layer. Each electrode is preferably fabricated from a reflective conductive material (e.g., aluminum, platinum, and chrome), or a transparent conductive material (e.g., indium tin oxide). The electronic ink layer is preferably one of several commercially available electrophoretic inks having thin electrophoretic film with millions of tiny microcapsules in which positively charged white particles and negatively charged black particles are suspended in a clear fluid.

Each embodiment of electronic ink stack 70 in accordance with the present invention can further employ a photoconductor layer (e.g.., Polyvinylcarbazole with trinitrotrinitrofluorenone or dilithium phthalocyanine as charge generation dopant).

Location codes for electronic ink stack 70 are embedded within the front electrode, the back electrode, and/or the photoconductor layer (if employed). In practice, the actual form, shape and dimensions of the location codes are dependent upon the intended commercial application of an embodiment of electronic ink stack 70. Thus, the inventors of the present invention do not impose any restrictions as to the form, shape and dimensions of the embedded location codes, and do not assert any "best form", any "best shape" or any "best" dimensions of the embedded location codes. Furthermore, the inventors of the present invention do not imposes any restrictions as to the coding scheme implemented by the location codes.

FIGS. 2-7 illustrate three exemplary embodiments of electronic ink stack 70, which are not drawn to scale, but drawn to facilitate an understanding of the various principles of underlying the embedded location codes.

Referring to FIGS. 2 and 3, a first exemplary embodiment of electronic ink stack 70 employs a bottom electrode 71, a photoconductor layer 72, an electrophoretic ink layer 73, and a front electrode 74. Electronic ink stack 70 further employs embedded location codes in the form of insulation pads 75 disposed within or on a photoconductor layer 72. Insulation pads 75 function as local resistors. Accordingly, an application of a voltage V as illustrated in FIG. 3 between electrodes 71 and 74 by controller 60 (FIG. 1) establishes a voltage drop across photoconductor layer 72 and electrophoretic ink layer 73 in areas of photoconductor layer 72 between insulation pads 75. Conversely, an application of the voltage V between electrodes 71 and 74 establishes a voltage drop across photoconductor layer 72, insulation pad 75, and electrophoretic ink layer 73 in areas of photoconductor layer 72 having insulation pads 75.

Referring to FIGS. 4 and 5, a second exemplary embodiment of electronic ink stack 70 employs bottom electrode 71, a photoconductor layer 76, electrophoretic ink layer 73, and a front electrode 74. Electronic ink stack 70 further employs embedded location codes in the form of indentations 77 within photoconductor layer 76. These are local areas of reduced thickness in the photoconductor. Indentations 77 function to reduce the resistive strength of photoconductor layer 76 in areas of photoconductor layer 76 having indentations 77. Accordingly, an application of a voltage V as illustrated in FIG. 3 between electrodes 71 and 74 by controller 60 (FIG. 1) establishes a voltage drop across photoconductor layer 76 and electrophoretic ink layer 73 whereby the resistance to the voltage drop is greatest in areas of photoconductor layer 76 between indentations 77.

Referring to FIGS. 6 and 7, a third exemplary embodiment of electronic ink stack 70 employs bottom electrode 78, a photoconductor layer 72, electrophoretic ink layer 73, and a front electrode 74. Electronic ink stack 70 further employs embedded location codes in the form of holes 79 extending through back electrode 78. Accordingly, an application of a voltage V as illustrated in FIG. 6 between electrodes 78 and 74 by controller 60 (FIG. 1) establishes a voltage drop across photoconductor layer 72 and electrophoretic ink layer 73 whereby the resistance to the voltage drop is greatest in areas of photoconductor layer 72 and electrophoretic ink layer 73 where electrodes 78 and 74 overlap.

FIG. 8 illustrates a flowchart 80 representative of a method of producing various images in the exemplary embodiments of electronic ink stack 70 illustrated in FIGS. 2-7.

Referring to FIG. 8, a blank image in the form a black blank image 90 or a white blank image 91 is produced during a stage S82 of flowchart 80. In the embodiments of stage S82, as illustrated in FIGS. 9 and 10, the voltage V applied to the electrodes during stage S82 is in the form of erasing voltage pulses having a magnitude V_E+ for switching the electronic ink layer to an entirely black state to produce black blank image 90, or to an entirely white state to produce white blank image 91.

Referring again to FIG. 8, a coded image in the form a black coded image 92 or a white coded image 93 is produced during a stage S84 of flowchart 80. In one embodiment of stage S84, as illustrated in FIG. 9, the voltage V applied to the electrodes during stage S84 is in the form of coding voltage having a magnitude V_{C1}- for switching areas of the electronic-eink layer corresponding to either the embedded location codes or the surrounding area. The latter being in the case when the location codes are formed by local insulating pads, and the former when employing indentations in the local thickness of the photoconductor layer. The transition from the erasing voltage pulse V_E+ pulse to the coding voltage pulse V_{C1}- is appropriately sloped in FIG. 9 in order to avoid transient effects as would be appreciated by one having ordinary skill in the art. This allows the location codes and the surrounding area to be switched separately to thereby prevent all areas of the electronic ink layer from switching from black to white, or vice-versa.

In another embodiment of stage S84, as illustrated in FIG. 10, the voltage V applied to the electrodes during stage S84 is in the form of a coding voltage having a magnitude V_{C2}- for switching areas of the electronic ink layer either corresponding to the embedded location codes or the surrounding area. The transition from the erasing voltage V_E+ pulse to the coding voltage pulse V_{C1}- is appropriately sloped in FIG. 10 to prevent all areas of the electronic ink layer from switching from black to white, or vice-versa. Furthermore, the slope of the FIG. 10 transition, which is greater than the slope of the FIG. 9 transition, is so chosen so that the transient effect will switch either the areas of the electronic ink layer not corresponding to the embedded location codes or the surrounding area. Although the absolute magnitude of the applied voltage V remains unchanged, a variation in local capacitance allows preferential switching of either the location codes or the surrounding area.

Referring again to FIG. 8, a pictorial image, such as, for example, a pictorial image 94 is produced during a stage S86 of flowchart 80. In embodiments of stage S86, as illustrated in FIGS. 9 and 10, the voltage V applied to the electrodes during stage S86 is in the form of a writing voltage having a magnitude voltage V_W that is held constant during this period. Electronic brush 50 (FIG. 1) is utilized during stage S86 to create the appropriate grey levels within the pictorial image. To this end, electronic brush 50 is moved over the electronic ink stack whereby, after detection of location code, electronic brush 50 is operated to apply laser pulse(s) for creating the appropriate grey level(s) associated with the detected location codes. As known in the art, the creation of the appropriate grey level(s) is dependent upon the light intensity and/or pulse period of the laser pulse(s).

It may be observed that the location codes are not sufficiently well written with the same intensity or period of laser light as the surrounding area. As would be appreciated by those having ordinary skill in the art, the possibility exists to vary the laser parameters in order to correct for when a location code is being re-written as a grey level.

While the embodiments of the invention disclosed herein are presently considered to be preferred, various changes and modifications can be made without departing from the spirit and scope of the invention. The scope of the invention is indicated in the appended claims, and all changes that come within the meaning and range of equivalents are intended to be embraced therein.

CLAIMS

1. An electronic ink stack (70), comprising:
a front electrode (74);
a back electrode (71, 78);
an electronic ink layer (73) disposed between said front electrode (74) and said back electrode (71, 78); and
at least one location code (75, 77, 79) embedded within at least one of said front electrode (74) and said back electrode (71, 78).

2. The electronic ink stack (70) of claim 1,
wherein said electronic ink layer (73) includes an electrophoretic ink.

3. The electronic ink stack (70) of claim 1,
wherein a first location code is a hole (79) extending through said back electrode (78).

4. The electronic ink stack (70) of claim 1,
wherein a first location code is a hole (79) extending through said front electrode (74).

5. The electronic ink stack (70) of claim 1,
wherein an application of a coding voltage pulse between said front electrode (74) and said back electrode (71, 78) produces a coded image for revealing at least one location code (75, 77, 79).

6. The electronic ink stack (70) of claim 1,
wherein an implementation of a voltage amplitude modulation technique facilitates a sequential production of a blank image (90, 91), a coded image (92, 93) and a pictorial image (94) in said electronic ink layer (73).

7. The electronic ink stack (70) of claim 1,

wherein an implementation of a voltage slope modulation technique facilitates a sequential production of a blank image (90, 91), a coded image (92, 93) and a pictorial image (94) in said electronic ink layer (73).

8. The electronic ink stack (70) of claim 1, further comprising:

a photoconductor layer (72, 76) disposed between said front electrode (74) and said back electrode (71, 78).

9. The electronic ink stack (70) of claim 8,

wherein said least one location code (75, 77, 79) is embedded within at least one of said front electrode (74), said back electrode (71, 78) and said photoconductor layer (72, 76).

10. The electronic ink stack (70) of claim 9,

wherein a first location code is an insulation pad (75) disposed within or on top of said photoconductor layer (72, 76).

11. The electronic ink stack (70) of claim 9,

wherein a first location code is a local thickness variation (77) in said photoconductor layer (72, 76).

12. An electronic ink system (20), comprising:

an electronic ink stack (70) including

a front electrode (74),

a back electrode (71, 78),

an electronic ink layer (73) disposed between said front electrode (74) and said back electrode (71, 78), and

at least one location code (75, 77, 79) embedded within at least one of said front electrode (74) and said back electrode (71, 78); and

a controllable voltage source (60) operable to apply voltages between said front electrode (74) and said back electrode (71, 78).

13. The electronic ink system (20) of claim 12,
wherein said electronic ink layer (73) includes an electrophoretic ink.

14. The electronic ink system (20) of claim 12,
wherein a first location code is a hole (79) extending through said back electrode (78).

15. The electronic ink system (20) of claim 12,
wherein a first location code is a hole (79) extending through said front electrode (74).

16. The electronic ink system (20) of claim 12,
wherein said controllable voltage source (60) is operable to apply a coding voltage pulse between said front electrode (74) and said back electrode (71, 78) to thereby produce a coded image for revealing the at least one location code (75, 77, 79).

17. The electronic ink system (20) of claim 12,
wherein said controllable voltage source (60) is operable to implement a voltage amplitude modulation technique to thereby facilitate a sequential production of a blank image (90, 91), a coded image (92, 93) and a pictorial image (94) in said electronic ink layer (73).

18. The electronic ink system (20) of claim 17, further comprising:
an electronic brush (50) operable in conjunction with said controllable voltage source (60) to produce the pictorial mage in said electronic ink layer (73) as a function of the at least one location code (75, 77, 79).

20. The electronic ink system (20) of claim 12,
wherein said controllable voltage source (60) is operable to implement a voltage slope modulation technique to thereby facilitate a sequential production of a blank image (90, 91), a coded image (92, 93) and a pictorial image (94) in said electronic ink layer (73).

21. The electronic ink system (20) of claim 20, further comprising:

an electronic brush (50) operable in conjunction with said controllable voltage source (60) to produce the pictorial mage in said electronic ink layer (73) as a function of the at least one location code (75, 77, 79).

22. The electronic ink system (20) of claim 12, wherein said electronic ink stack (70) further includes:

a photoconductor layer (72, 76) disposed between said front electrode (74) and said back electrode (71, 78).

23. The electronic ink system (20) of claim 22,

wherein said least one location code (75, 77, 79) is embedded within at least one of said front electrode (74), said back electrode (71, 78) and said photoconductor layer (72, 76).

24. The electronic ink system (20) of claim 23,

wherein a first location code is an insulation pad (75) disposed within said photoconductor layer (72, 76).

25. The electronic ink system (20) of claim 24,

wherein a first location code is a local thickness variation (77) in said photoconductor layer (72, 76).

ABSTRACT

An electronic ink stack (70) employs a pair of electrodes (71, 74, 78), an electronic ink layer (73), and an optional photoconductor layer (72, 76). The electronic ink layer (73)and the photoconductor layer (72, 76), if employed, are disposed between the electrodes (71, 74, 78),. One or more location codes (75, 76, 79) are embedded within the electronic ink stack (70) in one or both electrodes (71, 74, 78), and/or the photoconductor layer (72, 76) , if employed.

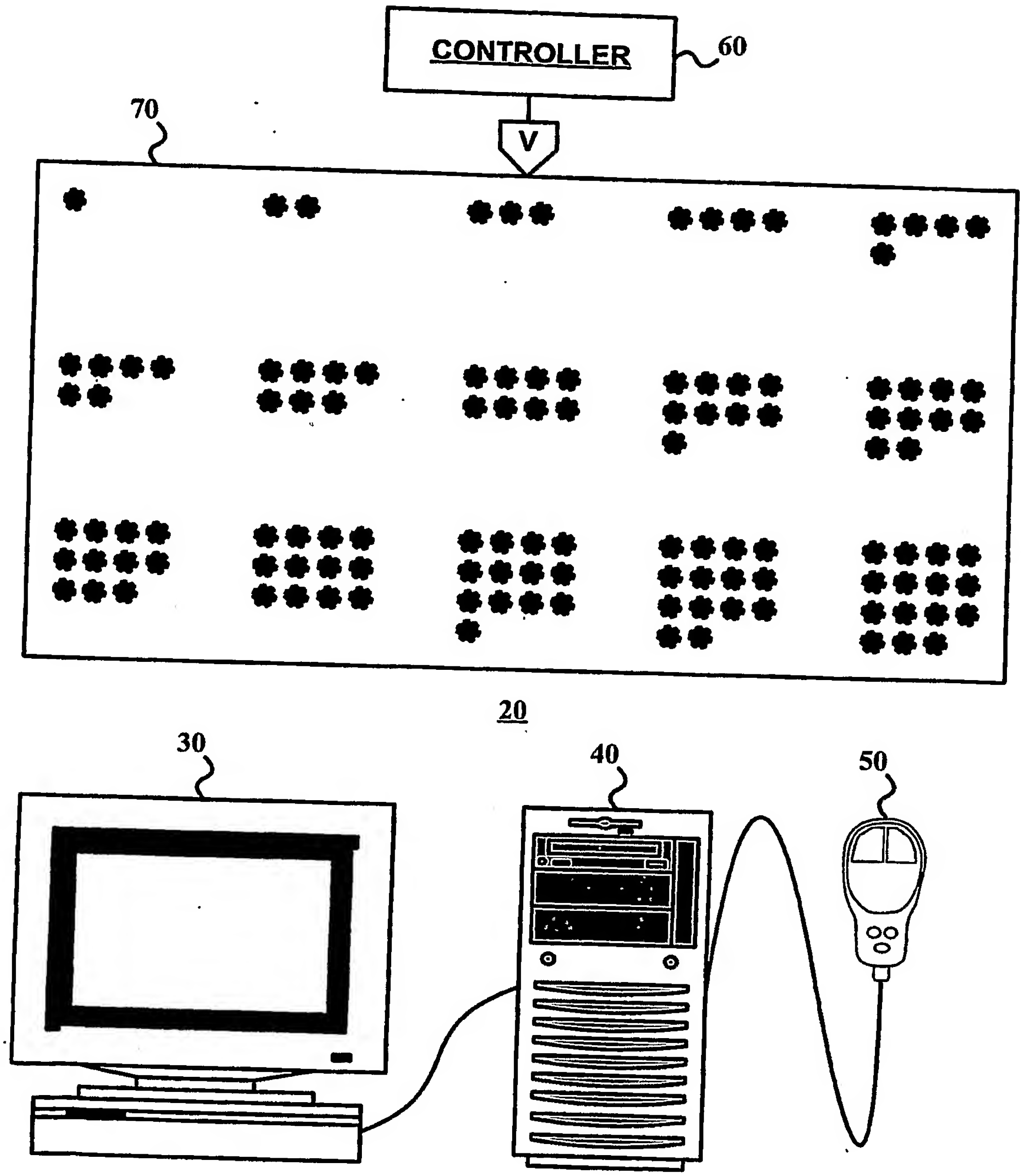

FIG. 1

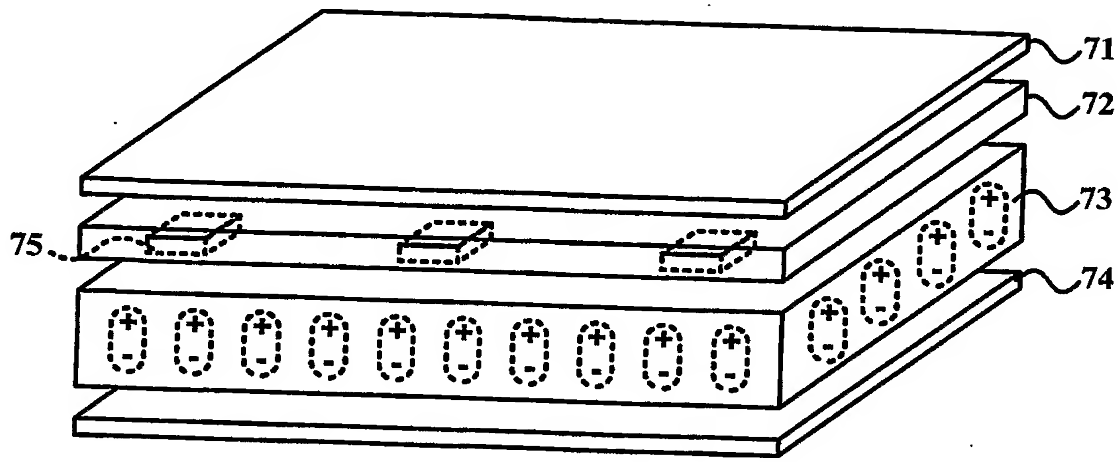

FIG. 2

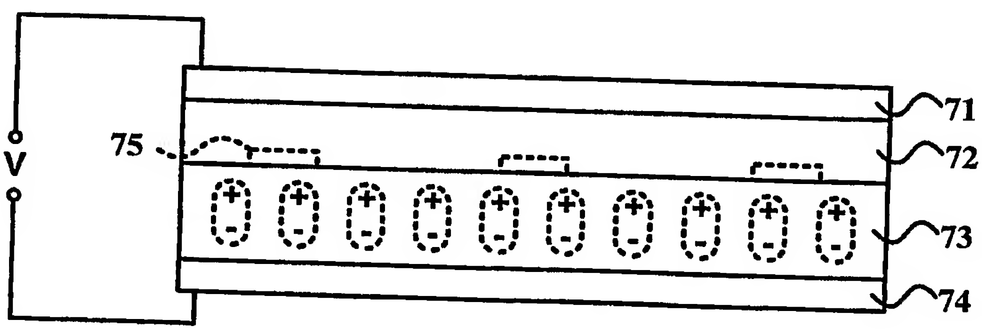

FIG. 3

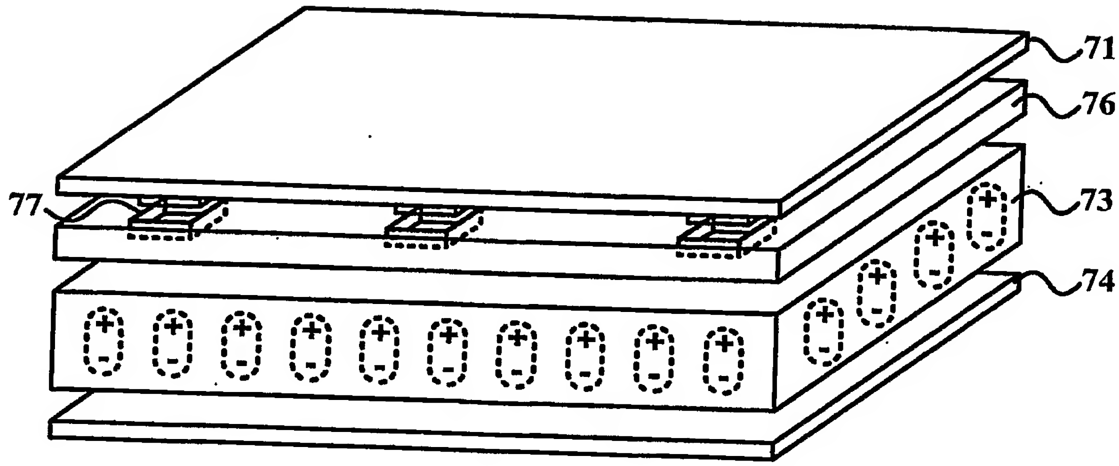

FIG. 4

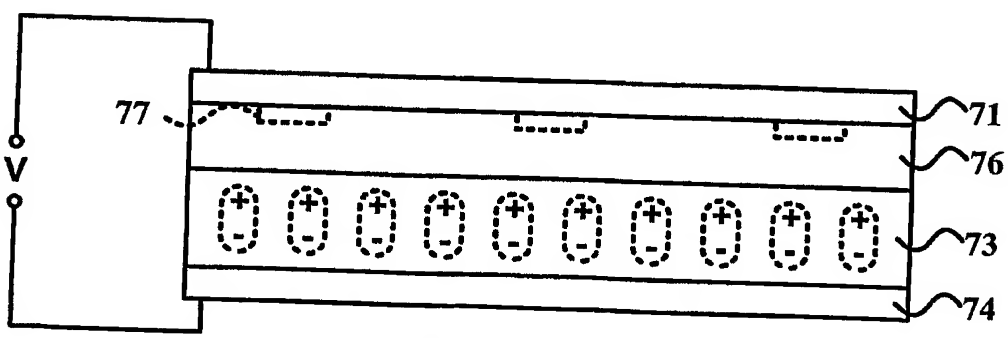

FIG. 5

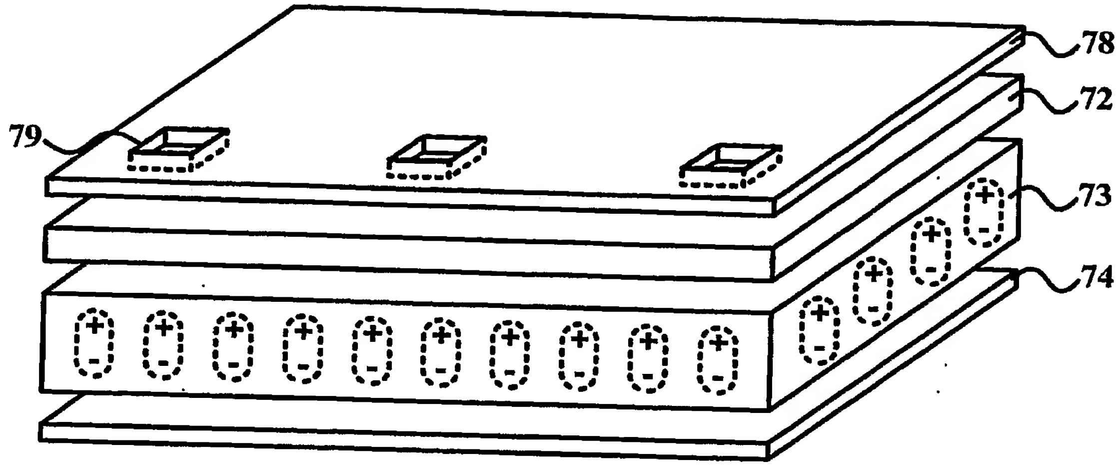

FIG. 6

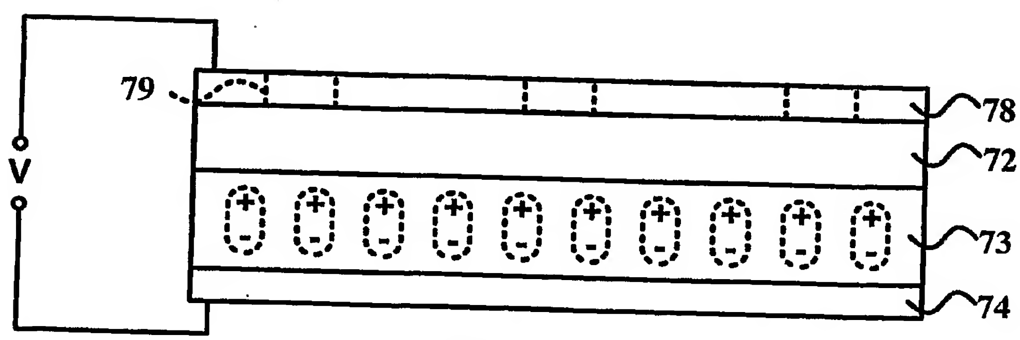

FIG. 7

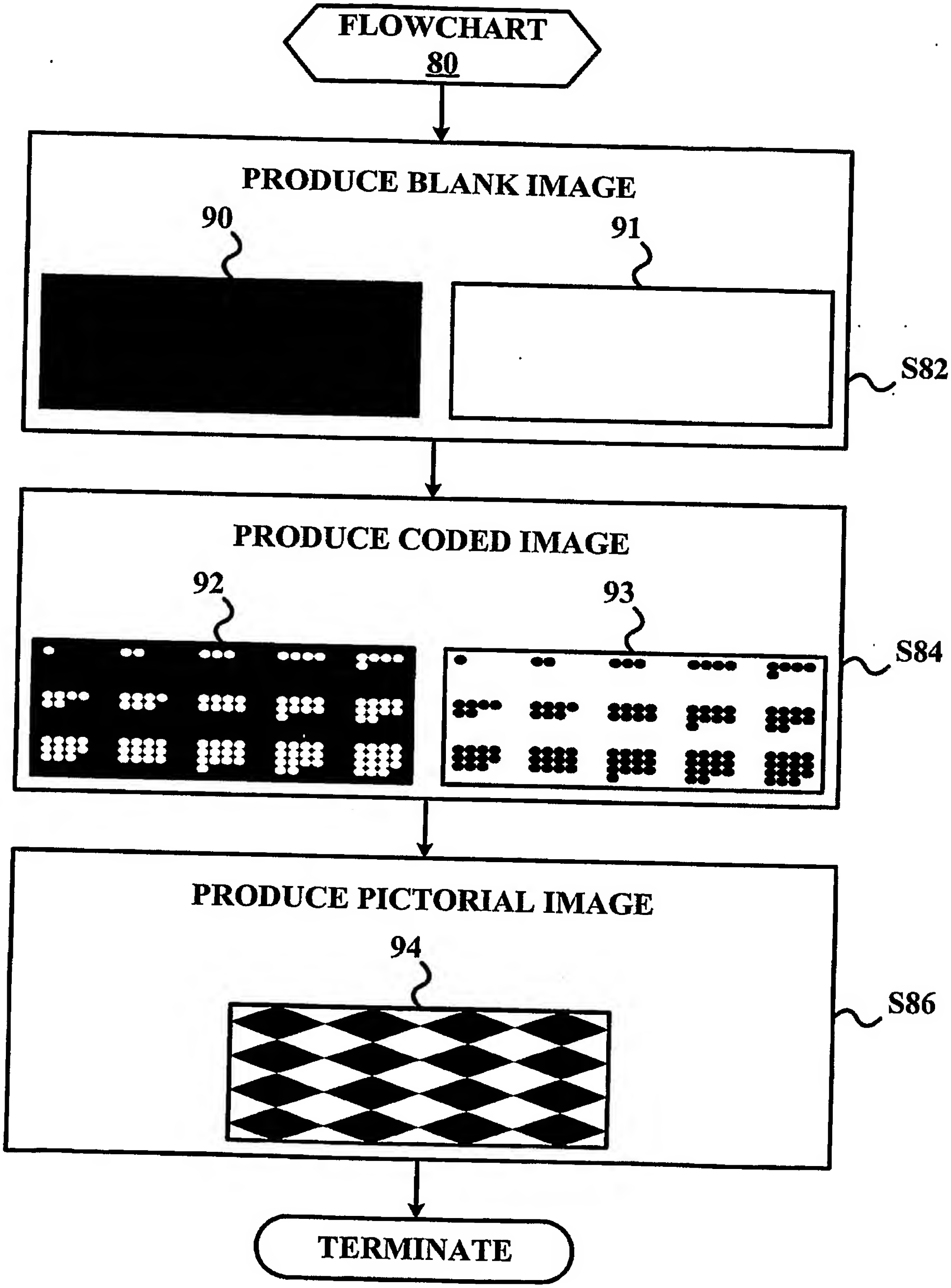
FLOWCHART
80
PRODUCE BLANK IMAGE
90
91
S82
PRODUCE CODED IMAGE
92
93
S84
PRODUCE PICTORIAL IMAGE
94
S86
TERMINATE

FIG. 8

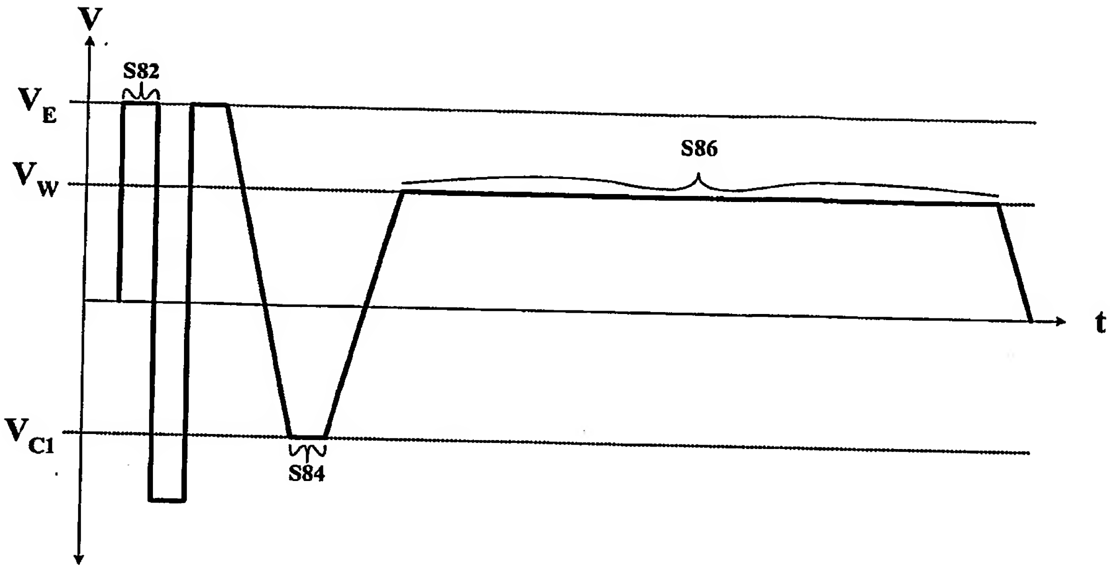

FIG. 9

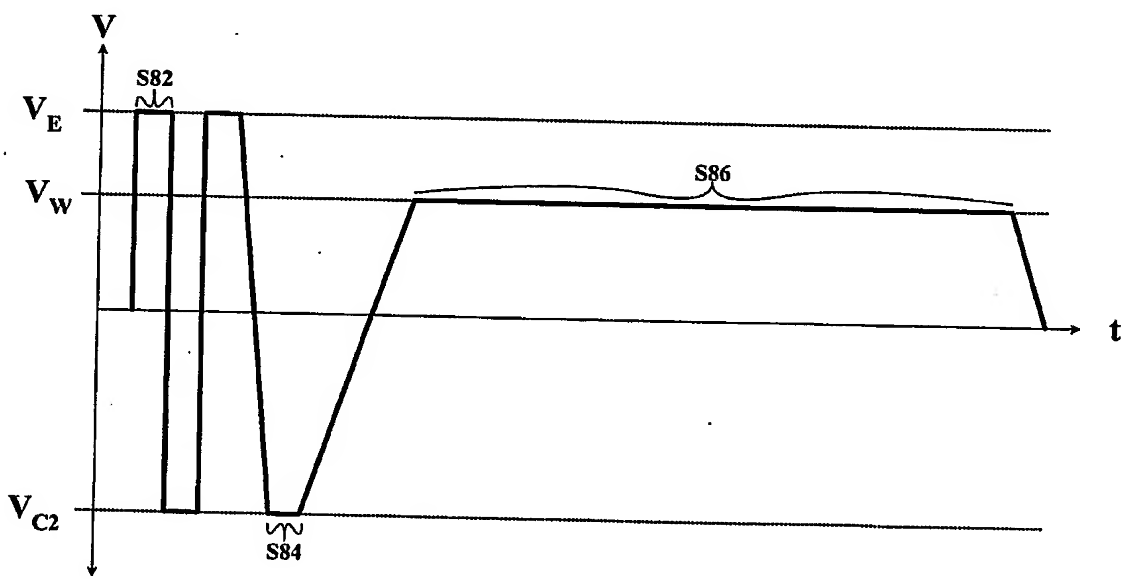

FIG. 10